Quantum-Inspired Classical Computing (QuICC)

Frequently Asked Questions (FAQ) Document

Updated on October 14, 2021

1) **Question: Will the slides of the presentations be available?**

   Answer: Proposers Day materials are posted online at https://www.darpa.mil/work-with-us/opportunities. We recommend selecting "Microsystems Technology Office (MTO)" in the "FILTER" box when searching for the QuICC program.

2) **Question: Can we get copies of all the briefings and can we also get a list of the participants and their contact info. This list would be very helpful to potential teaming opportunities.**

   Answer: Proposers Day materials are posted online at https://www.darpa.mil/work-with-us/opportunities, and the contact information of those registrants who elected to share their information was emailed on October 7, 2021 to all who registered for Proposers Day.

3) **Question: Shall I wait for the Slides and Video from today's Proposer's Day to appear on the web site: https://sam.gov/opp/2993d1848d1e4f9e881422d698f0a879/view, or should I be following a different web site?**

   Answer: See the response provided to question 1) above.

4) **Question: There was not much details in the slides about TA2. It was mostly on TA1.**

   Answer: The QuICC Proposers Day slides only provide a brief overview of the program. Please see the BAA for details on both TA1 and TA2.

5) **Question: BAA HR001121S0041 states that eligible participants are FFRDC, government entities and non-US / individuals. I would like to confirm that this was not meant to exclude private US vendors from supporting this effort. [Entity][1] has a partnership with [entity] and is very interested in this effort and would hope we can support if possible. Can you please clarify our eligibility?**

   Answer: Part II. Section III.A ("Eligible Applicants") (p. 26) of the QuICC BAA states "All responsible sources capable of satisfying the Government's needs may submit a proposal that shall be considered by DARPA". The BAA does not exclude private US vendors from supporting this effort.

6) **Question: How many awards are expected to be made for Phase 0 effort and is there a planned downsizing of performer teams as the program moves to phases 1 and 2?**

   Answer: The QuICC phases are designated 1, 2, 3 (not 0, 1, 2). As stipulated in the BAA, multiple awards are anticipated. It is expected that fewer performers will be funded (options exercised) to participate in Phase 2 and Phase 3 of the program. Phase 2 and 3 options may be exercised,

[1] Entity names have been redacted to “[entity].”

at the Government's sole discretion, based on technical progress measured against the metrics and milestones defined in the BAA and on funding availability.

7) **Question: How will the government team's effort be included in the proposal? and with the work with the Government's team included in the proposal cost?**

   Answer: The Government team effort should not be a part of a proposer's proposal. Hours to interact with the Government team, however, can be included (for example, to support Government testing for a specific period of time).

8) **Question: [Entity] is interested in the Quantum-Inspired Classical Computing (QuICC) BAA and we are curious if we are allowed to submit more than one project/proposal for the same BAA.**

   Answer: A proposer can submit more than one proposal, and a team/organization/individual can be on more than one proposal.

9) **Question:**
   a. **How many teams/proposals is a single university investigator allowed to be a subawardee/Co-PI on?**

      Answer: The QuICC BAA does not place any limitation on the number of teams one can participate in. A proposer can submit more than one proposal, and a team/organization/individual can be on more than one proposal.

   b. **If the answer is more than one, then I also have a quick follow-up question: is it required for this investigator's proposed work to be completely distinct between the different teams/proposals, or can there be overlap in their proposed work across teams?**

      Answer: A proposer can submit more than one proposal, and a team/organization/individual can be on more than one proposal. Moreover, it is not required that the investigator's proposed work be completely distinct between the different teams/proposals.

10) **Question: "Anticipated funding type: 6.2"; What is the expected ownership of IP's resulted from the project? Or any expected restrictions?**

    Answer: As stated in the BAA, funding type is 6.2 (Applied Research). Regarding intellectual property (see p. 24 of the BAA, and also references to other sections therein) the Government desires no less than Government Purpose Rights for TA 1 and TA 2. All proposed intellectual property must be clearly identified (in the prescribed format) and must provide a justification for the basis of assertions to include how each item will be used to support the proposed research project.

11) **Question: Would a digital based solution that includes an FPGA component be considered where the FPGA is simulating the physical portion of the system that could be implemented later?**

    Answer: The QuICC program seeks to develop QI solvers, which are mixed-signal systems consisting of analog hardware and digital logic subsystems. As stated on page 5 of the BAA,

proposals for all-digital solvers are out-of-scope. Digital computations of equations governing dynamical systems (FPGA-based or otherwise) do not constitute the analog hardware targeted by the QuICC program. Please see BAA for details (Part II. Section I. "Funding Opportunity Description").

12) **Question: To what extent the program is open to analog technologies that are not Ising-based?**

    Answer: The QuICC program is not restricted to Ising-based approaches. Please see the BAA (p.7) for the definition of a QI solver.

13) **Question: I would like to submit proposal to modeling to prediction materials and properties. Is this program suitable for basic research on physics?**

    Answer: Please see BAA for full proposal requirements. QuICC is compatible with both fundamental and non-fundamental research (see BAA, Section II, Award Information, Paragraph B, Fundamental Research, p. 25) as part of a complete proposal satisfying all proposal requirements listed in the BAA.

14) **Question: How important is generality of the mapper vs. optimizations possible for the challenge problems?**

    Answer: The more general the solution, the more impactful it could be to the DoD mission. Please see Part II, Section V.A. “Evaluation Criteria” (p. 50) of the BAA for details.

15) **Question: Does TA2 require actual hardware in addition to system modeling?**

    Answer: Yes, please see BAA for details, Part II, Section I.D. "Technical Area 2 (TA2): Analog Hardware Prototyping" (pp. 14-17)

16) **Question: Are we expected to also build digital interfaces to analog hardware in TA2? Or, if that performance is estimated based on simulation models.**

    Answer: Yes, please see BAA (pp. 14-17) for details on requirements of hardware interfacing with, and integration to, TA1 solver framework.

17) **Question: Is there any requirements on the reprogramming time/latency of the hardware? Or all the benchmarks are assuming solving a single problem?**

    Answer: The key metric is total energy to solution, not execution time. Please see BAA (pp. 10 - 20) for details on Technical Areas, milestones and metrics. Milestone progress will be determined by a statistical evaluation of performance on multiple problem instances.

18) **Question: Will the government provide fabrication for TA2's IC(s)?**

    Answer: Please reach out to the target foundry for cost and schedule information, and include it in the proposal. This also applies if the target foundry is a Government or FFRDC foundry.

19) **Question: Should fabrication costs be included in the budget? Does QuICC prefer on shore foundries?**

Answer: Please include all associated costs in the proposal. Please see BAA for details (p. 35). QuICC does not have any preference regarding the location of a foundry. It is the proposer's responsibility to follow all applicable government regulations even when utilizing on-shore foundries. Please also refer to BAA Attachment 3 "QuICC CUI Guide" for export control restrictions on design and fabrication.

20) **Question: Will DARPA specify what is the cSoA for the required problem classes, or is the proposers responsibility to identify those?**

Answer: Examples of cSoA for the required problem classes (SAT, MLE, MFMC, and MILP) are cited in the BAA (in the footnotes therein). The Government Team will provide further guidance during the program.

21) **Question:**
    a. **Page 17 of the BAA indicate examples of problems from the four problem classes you selected (PPP is the fifth one) – there is no expectation that performers pick specific problems from the examples on page 17 of the BAA, correct?**

    Answer: Specific problems in each of 4 program specified problem classes (SAT, MLE, MFMC, and MILP) will be provided as Government Furnished Information (see Part II, Section I.G. “Government Furnished Equipment/Property/Information” (p. 23) of the BAA for more details). Note: Multiple instances of each problem will be provided as Government Furnished Information for use in demonstrating performance toward program milestones.

    b. **You indicate four problem classes and the fifth one is PPP. How many specific problems from every class of problems would be needed to be indicated in the proposal?**

    Answer: Regarding the four problem classes, see answer to a.) above. Regarding the PPP, at least one problem from each PPP class that is proposed. Note: During program execution, the performer will be expected to provide multiple PPP instances for use in demonstrating performance toward program milestones in each program phase.

22) **Question: I have some questions about the specific problems from the problem classes you indicated – how do we qualify on whether or not a specific problem is DOD relevant?**

Answer: For the four problem classes (SAT, MLE, MFMC, MILP), no justification of DoD relevance is required. The Performer Proposed Problem (PPP) specifications should include: a) descriptions of related DoD mission(s), b) the mission impact of increased computational efficiency; and c) the associated energy-to-solution for conventional state-of-the-art solvers for each program phase’s specific problem size. Please see p. 18 of the BAA for details.

23) **Question:**
    a. **Could you please expand on what you mean by the target for the analog hardware to have resource costs scaling as N^c where c<1.5? (Where N is the number of problem variables.)**

Answer: Please see BAA (*e.g.*, p. 19) for the definition of scaling exponent, which is in terms of "analog dynamical system elements (used for embedding problem variables)."

b. For example in an Ising/QUBO problem there are O(N^2) connections, the computation performed would naturally require at least O(N^2) resources if you define resources as time + space(components). So by targeting N^1.5 scaling, do we mean we want the number of physical components in the analog hardware to scale like this, but the system can use time multiplexing to make up for the "missing" resources?

Answer: The scaling exponent is defined in terms of analog dynamical system elements – not the connections between them – used for embedding problem variables (see e.g., p. 19 of the BAA). The BAA requires that the scaling of dynamical systems to be less than N^1.5, where N is the problem size (see pp. 15-16, 18 of the BAA), without any form of multiplexing or problem decomposition.

24) Question:

a. I am planning to apply for the QuICC program. I wonder if you can share information on the anticipated budget and whether small teams are also encouraged. I could not find this information in the BAA.

Answer: As stated in Part I of the BAA (p. 4), the anticipated funding available for award is approximately $58M. The QuICC BAA does not place any limitation on the size of a proposer team; rather, all full proposals must address both technical areas, TA1 and TA2 (see. e.g., Part II, Section I.C. “Program Structure” on p. 9, or Part II, Section IV.B.2. “Full Proposal Format” on p. 30).

b. Also, unfortunately, I missed the proposer workshop and I would be very grateful to get a copy of the workshop slides.

Answer: Please see answer to 1) above.

25) Question:

a. **Are multiple semiconductor approaches considered as different approaches for TA2 or as one approach? e.g. different underlying circuit approaches.**

Answer: As stated in the BAA (p.14), "Proposers are discouraged from submitting variations of a core technology as separate TA2 approaches, e.g., different types of semiconductor-based circuits. Instead, proposers should incorporate trade-off studies and potential design variations to mitigate technical risks into one TA2 approach for each core technology proposed."

b. Does a list of references cited count towards proposal page limits?

Answer: No. Per the BAA, Section II of Volume I, Technical and Management Proposal falls within the page limitations detailed (see “Full Proposal Format” on page 30 of the BAA). A bibliography may be included in Section III. Additional Information.

26) **Question: Are there any restrictions or special conditions for foreigner nationals (non-US citizens) to be a part of the proposed research team? Are those foreign nationals allowed to be a part of the research team, or are they allowed to be on the principal roles?**

Answer: Per the BAA Section III.A.2. Other Applicants, “Non-U.S. organizations and/or individuals may participate to the extent that such participants comply with any necessary nondisclosure agreements, security regulations, export control laws, and other governing statutes applicable under the circumstances.”

27) **Question: We would like to submit an abstract by 10/25. Is participation in the proposers meeting a requirement for this?**

Answer: No, Proposers Day participation is not required to submit an abstract or proposal.